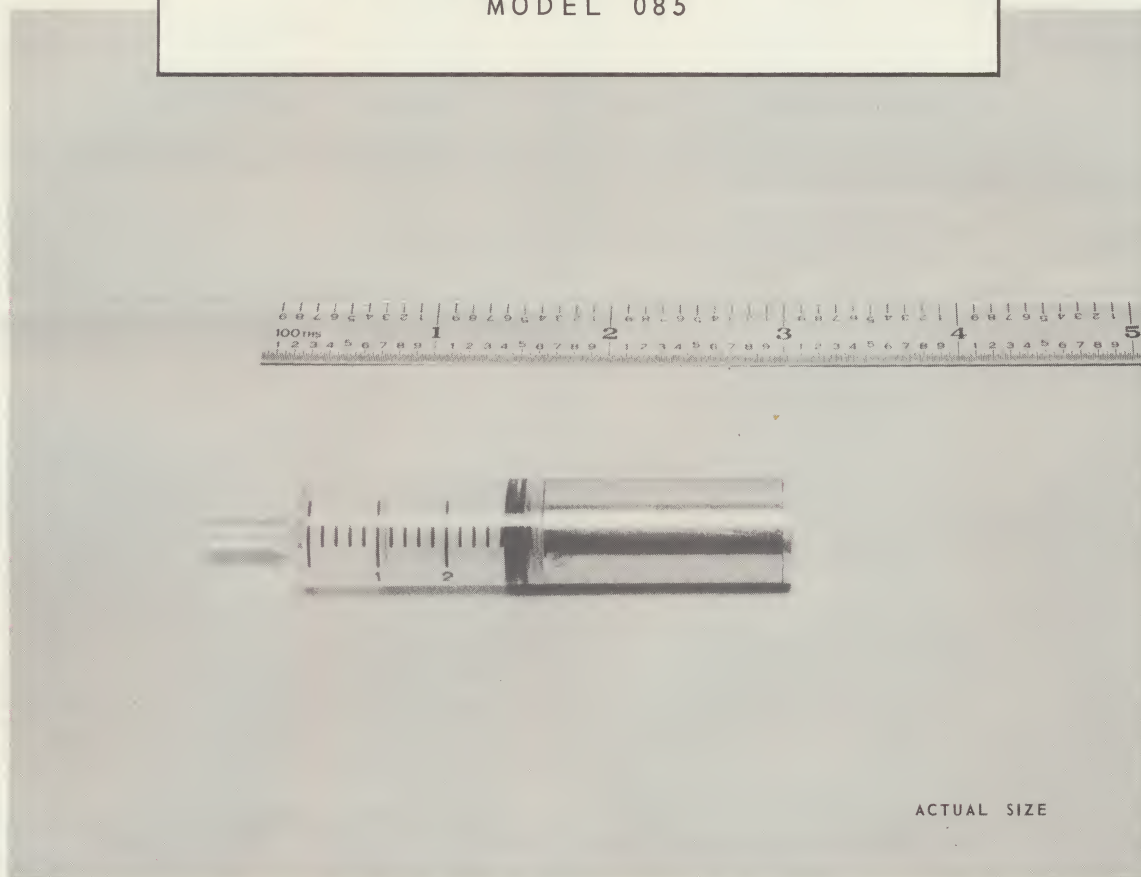


**SAGE**  
INSTRUMENTS

**SAGE MICRO-FLOW PUMP\***  
MODEL 085



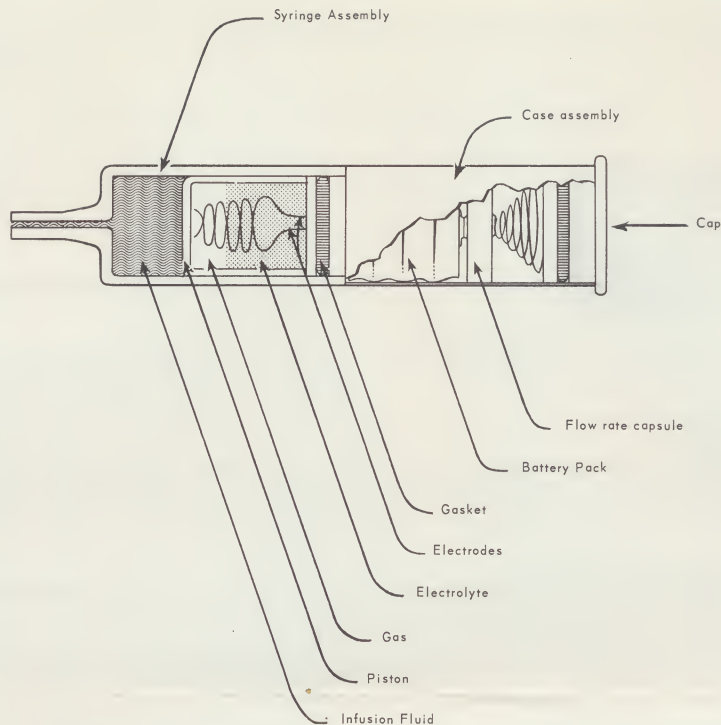
**GENERAL DESCRIPTION**

The Sage Micro-Flow Pump is a miniature, lightweight, portable, battery-operated pump. It is ideally suited to continuous infusion of fluid into unrestrained animals and to a host of other laboratory uses. The pump can be used for infusing heparin, tranquilizers, radioactive materials, and various drugs and chemicals. Capacity is 1 ml. Its unique electrolytic pumping principle permits setting it to pump at a variety of rates from 1 ml/½ hr to 1 ml/20 hr. The pumping rate is determined by the Flow Rate Capsule selected. Throughout the run, flow rate is linear. It is remarkably reproducible.

The Micro-Flow Pump works by electrolysis, uniformly generating a gas that moves a piston which drives the fluid. It consists of a syringe assembly which includes the piston, and a case assembly which includes the electrodes, battery pack, flow rate capsule, gaskets, and cap. The pump comes complete and ready for use, with 1 ml/hr flow rate capsule, battery pack, and a supply of electrolyte.

\*patent pending

ACTUAL SIZE



## SPECIFICATIONS

Capacity	1 ml
Length	3.2 inches
Diameter	5/8 inch
Weight (unfilled)	27 grams
Materials	Syringe and piston: glass Case assembly: stainless steel.
Battery Pack Life	100 ma-hr (approximately 25 ml of pumping) Shelf life is approximately one year.
Electrolyte	60ml supplied with pump. (1.5 ml of fresh electrolyte is used in each run)

## \*Flow Rate Capsules (Last indefinitely)

Color Code	Flow Rate
Brown	1 ml/½ hr
Green	1 ml/hr
Red	1 ml/2 hr
Black	1 ml/4 hr
White	1 ml/8 hr
Yellow	1 ml/12 hr
Blue	1 ml/20 hr

\*Flow rates are nominal; individual capsules may vary  $\pm 10\%$ . A single run with electrolyte and battery pack at full strength will establish the flow rate for any particular capsule. Thereafter, minor variations can be caused by changes in electrolyte strength or battery voltage. Flow rate is, however, always linear.

## OPERATION

Operation is simple. The battery pack and appropriate flow rate capsule are placed in the case assembly, and the cap is secured. The fluid to be pumped is loaded, and the piston cup is filled with electrolyte. The syringe assembly and case assembly are fitted together, and the pump starts operating automatically.

(Specifications subject to change without notice.)

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SAGE INSTRUMENTS, INC.  
2 Spring Street  
White Plains, New York

SAGE MICRO-FLOW PUMP

Battery-operated Models

The Micro-Flow Pump is available in five models, all identical in principle to the Model 085 described in the catalog sheet. There are three capacities: 1 ml, 2 1/2 ml, and 10 ml.

Materials are: glass for syringe and piston; stainless steel for case assembly. Batteries are mercury cells which have shelf life of 1 year. Color-coded flow rate setting disks last indefinitely.

	Model 085	Model 127	Model 150	Model 172	Model 149
Capacity	1 ml	2 1/2 ml	2 1/2 ml	10 ml	10 ml
Length	3.2 inches	4.5 inches	4.5 inches	7.6 inches	8.2 inches
Diameter	5/8 inch	5/8 inch	5/8 inch	7/8 inch	7/8 inch
Weight (unfilled)	27 grams	29 grams	30 grams	160 grams	190 grams
Battery Pack Life	approx. 25 ml of pump- ing	approx. 25 ml of pump- ing	approx. 25 ml of pump- ing	approx. 180 ml of pump- ing	approx. 60 hr at fastest, 240 hr at slowest rate
Electrolyte	60 ml sup- plied with pump. 1.5 ml used in each run.	60 ml sup- plied with pump. 3 ml used in each run.	60 ml sup- plied with pump. 3 ml used in each run.	450 ml sup- plied with pump. 12 ml used in each run.	450 ml supplied with pump. 12 ml used in each run.
*Special Features			Automatic cut-off	Automatic cut-off	Automatic cut- off; constant current regu- lator

\*SPECIAL FEATURES

Automatic Cut-off

This shorts out the current from the electrolyte when the piston reaches the end of the cylinder and thus prevents further generation of gas. The automatic cut-off continues to drain the battery, and the pump should be disassembled at the end of its run in any event.

Constant Current Regulator

This epoxy-encapsulated electronic component insures reproducibility of flow rate within 2%, regardless of the state of the battery until it fails completely. Precision resistors supplied to go with the model having this component give more accurate flow rates than nominally available with other models.



### PUMPING CHARACTERISTICS

The Micro-Flow Pump operates by electrolysis. Immediately upon assembly, there is uniform generation of gas behind the piston, resulting in uniform flow at any flow rate. The pump is disassembled at the end of the run to prevent unnecessary battery drain and further generation of gas which eventually causes the syringe and case assemblies to separate or results in leakage of electrolyte around the piston and into the pumping chamber.

### FLOW RATES

Flow rate setter disks contain resistors which set the rate. Since resistors vary within a range of 5% and electrolyte voltage drops vary with time, the flow rates are nominal and may vary with particular rate-setters. A given rate-setter will, however, yield reasonably reproducible rates. The other variables affecting rates are battery voltage (this variable is eliminated in Model 149), temperature, electrolyte voltage drop, and of course back pressure. Flow is linear, except for a slight tail-off at the end of a run, and a momentary delay at the start.

### TEMPERATURE EFFECTS

An increase in the ambient temperature of 10° F will increase flow rate by approximately 2%. Since the pump can be immersed in fluid without affecting its operation, it is a simple matter to check out rates at given temperatures in a water bath. This can, of course, be done in an incubator. At any given temperature, the flow is linear.

### BACK PRESSURE

In pumping against back pressures of 180 mm Hg, the flow rate may be decreased by as much as 20%. At 100 mm Hg, the decrease in flow rate is approximately 12%. Because of the compressibility of the gas (hydrogen and nitrogen) generated by the electrolytic action, varying back pressure as encountered in an arterial system will produce an irregular pumping action. The exact effect will depend on the two pressures and the timing.

### APPLICATIONS

Some of the many applications follow: chemotherapy . chromatography . calibration of instruments requiring known quantities of a chemical or gas . feeding nutrients to cell cultures . infusion of radioactive materials . intravenous feeding . implantation in animals . drug experiments on unrestrained animals . infusion of materials into patients without confining them wherever slow infusion of fluids at controlled rates may be required.

**PRICE LIST FOR  
SAGE MICRO-FLOW PUMPS \*  
BATTERY OPERATED UNITS**

<u>Model No.</u>	<u>Capacity</u>	<u>Description</u>	<u>Price</u>
085	1 ml	Micro-Flow Pump, Complete	\$ 65.00
127	2 1/2 ml	Micro-Flow Pump, Complete	95.00
150	2 1/2/ml	Micro-Flow Pump with automatic cut-off, complete	115.00
172	10 ml	Micro-Flow Pump with automatic cut-off, complete	175.00
149	10 ml	Micro-Flow Pump with automatic cut-off and constant current regulator, complete	245.00

Complete units include Battery Pack, Electrolyte, 5 Rate Setters for pumping at following rates:

(1 ml/½ hr; 1 ml/hr; 1 ml/2 hr; 1 ml/8 hr; 1 ml/24 hr)  
(brown) (green) (red) (white) (blue)

**ACCESSORIES AND PARTS**

<u>Part No.</u>	<u>For Models</u>	<u>Description</u>	<u>Price</u>
M-106	085	Syringe Assembly (1 ml unit)	\$ 20.00
M-138	127	Syringe Assembly (2 1/2 ml unit)	20.00
M-161	150	Syringe Assembly W/ACO (2 1/2 ml unit)	25.00
M-175	149, 172	Syringe Assembly W/ACO (10 ml unit)	35.00
M-107	085, 127, 150	Battery (1 ml and 2 1/2 ml unit)	2.00
M-176	149, 172	Battery (10 ml unit)	1.00
M-104		Electrolyte (60 ml)	4.00
M-177		Electrolyte (450 ml)	20.00

**FLOW RATE SETTERS**

(These may be used indefinitely)

For Models 085, 127, 150 (1 ml & 2 1/2 ml Units)				For Model 172 (10 ml Unit)		For Model 149 (10 ml Constant Current Unit)	
<u>Flow Rate</u>	<u>Color</u>	<u>Part No.</u>	<u>Price</u>	<u>Part No.</u>	<u>Price</u>	<u>Part No.</u>	<u>Price</u>
1 ml/1/2 hr	Brown	M-108	\$6.00	M-181	\$6.00	M-188	\$12.00
1 ml/hr	Green	M-109	6.00	M-182	6.00	M-189	12.00
1 ml/2 hr	Red	M-110	6.00	M-183	6.00	M-190	12.00
1 ml/4 hr	Black	M-111	6.00	M-184	6.00	M-191	12.00
1 ml/8 hr	White	M-112	6.00	M-185	6.00	M-192	12.00
1 ml/12 hr	Yellow	M-113	6.00	M-186	6.00	M-193	12.00
1 ml/24 hr	Blue	M-114	6.00	M-187	6.00	M-194	12.00

\*Patent Pending

(Prices & specifications subject to change without notice)

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White Plains, New York 10601  
914 White Plains 9-4121

1/1/64 PRINTED IN U.S.A.

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## PRICE LIST FOR SAGE SYRINGE PUMPS

Constant Speed Models 234 and 249  
Variable Speed Models 237 and 255

Small Constant Speed Pumps Model 234-1 through 234-7	\$ 145.00
Large Constant Speed Pumps Model 249-1 through 249-6	215.00
Small Variable Speed Pumps Model 237-1 through 237-3	325.00
Large Variable Speed Pumps Model 255-1 through 255-3	395.00

## ACCESSORIES

Syringe holder for 20, 50 or 100 cc syringe (specify size)	15.00
Syringe holder for $\frac{1}{4}$ , 1, 2, 5, or 10 cc syringe (specify size)	10.00
Double Syringe holder for two syringes, $\frac{1}{4}$ , 1, 2, 5, 10, or 20 cc (specify syringe size)	16.00
Model 260 adaptor plate for using single or double syringe holders 10 cc or smaller on a Large Pump	10.00
Model 226 alternate gear set for Small Constant Speed Pumps	15.00
Model 259 alternate gear set for Large Constant Speed Pumps	15.00

(Syringes are not included with Pumps)

All prices F.O.B. White Plains, New York.

Terms: Net 30 days.

(Prices & specifications subject to change without notice)

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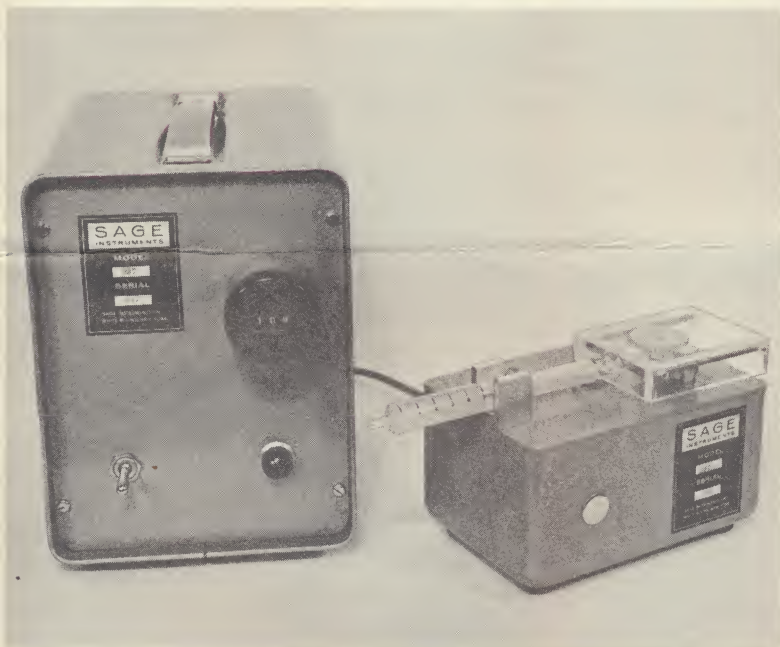
# SAGE

INSTRUMENTS

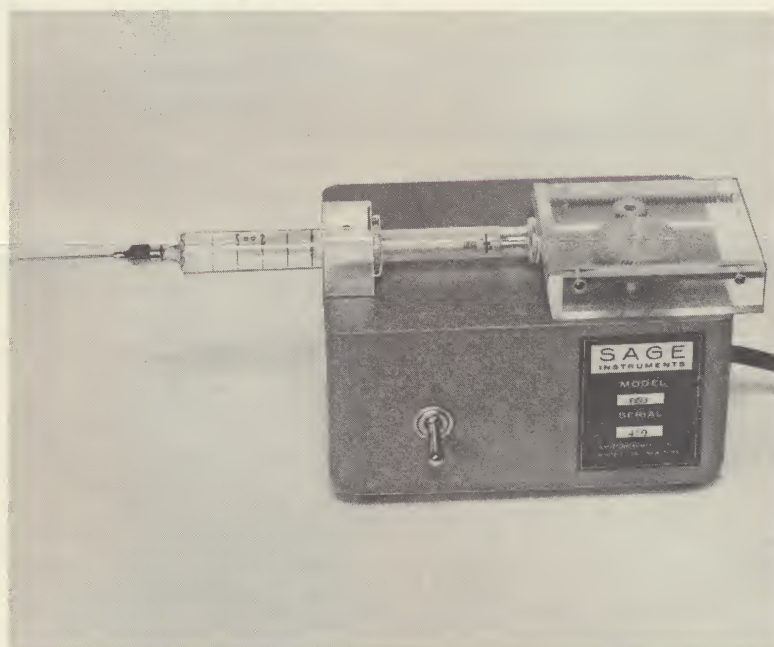
## SAGE SYRINGE PUMPS

Constant Speed Models 234 and 249  
Variable Speed Models 237 and 255

For Accurate, Reproducible Infusion of Fluids  
at Uniform Flow Rates . . . from 0.11 ml/day to 29.5 ml/min.



**MODEL 237 VARIABLE SPEED PUMP** connects to control box with 6' lead, is continuously adjustable over 40-1 range for each syringe (up to 10 cc size). Choice of three motor speeds. Model 255 (4½" longer) accepts up to 100 cc size syringes.



**MODEL 234 CONSTANT SPEED PUMP** accepts syringes from ¼ cc to 10 cc size, is driven by a synchronous motor. Quick change gears permit four rates for each size syringe. Model 249 (4½" longer) handles up to 100 cc size syringe.

### DESCRIPTION

Sage Syringe Pumps are designed to drive syringes at uniform rates for accurate and reproducible infusion of fluids. Two types are available: constant speed models permit pumping at a number of discrete rates; variable speed models offer continuously variable rates over a wide range. Each is available in two sizes. The large capacity units will handle up to 100 cc syringes; the small units, up to 10 cc syringes. Special fittings are available which permit driving two syringes (up to 20 cc size) simultaneously. All models are compact in size, light in weight, easy to use, and reliable in operation. Any fluid compatible with the glass of a syringe may be pumped, and syringes may be sterilized in any manner desired.

All units operate from 117 v AC 60 cps power.

The back pressures against which the pumps operate are a function of syringe size. The 100 cc syringe may be driven against pressures as great as 300 mm of Hg; the 10 cc syringe will pump against at least an atmosphere, and smaller size syringes will pump against still greater back pressures.



## THE PUMP MECHANISM

The pump consists of a compact box housing the motor and works. Above the box is a pair of gears (one drive and one idler) which engage mating racks on a driving carriage which drives the syringe plunger. Just before the plunger bottoms, the driving carriage simply disengages from the gears and pumping ceases. No cut off switch is necessary, and syringes cannot be damaged. The unit is readily reset for further pumping by simply lifting and repositioning the carriage.

The drive and idler gears may be quickly interchanged to provide different flow rates, and an alternate gear set (for constant speed models) provides additional rates.

The syringe holder is mounted with two screws and may be readily interchanged with holders for other size syringes.

## CONSTANT SPEED PUMPS

These are driven by synchronous motors (yielding better than  $\pm 0.1\%$  accuracy). Different flow rates are achieved by using different size syringes and by changing gears.

### MODEL 234 SMALL CONSTANT SPEED SYRINGE PUMP

This unit comes with a syringe holder for 5 cc syringes (others from  $\frac{1}{4}$  cc up to 10 cc available on order) and with a basic gear set (an alternate gear set is also available). Model 234 may be ordered with any of 7 different speed synchronous motors. The pump offers 4 rates (achieved by simply changing gears) for each of 5 different size syringes, giving a total of 20 possible rates for each motor.

SEE THE FLOW RATE CHART FOR DETAILS.

### MODEL 249 LARGE CONSTANT SPEED SYRINGE PUMP

This unit is supplied with a 50 cc syringe holder and its basic gear set. An alternate gear set has two identical gears, for a total of three possible speeds by virtue of gear changes. The Model 249 may be used with any of 8 different size syringes from  $\frac{1}{4}$  cc up to 100 cc, thus giving a total of 24 possible rates. It is available with any of 6 different speed synchronous motors.

SEE THE FLOW RATE CHART FOR DETAILS.

## VARIABLE SPEED MODELS

Each pump has a 6' lead which plugs into a separate control box which regulates DC permanent magnet motors to an accuracy of  $\pm 0.5\%$ , independent of changes in back pressure (within specifications stated above) and regardless of variations of line voltage up to  $\pm 10\%$ . The flow rate is set over a range of 16 to 1 by a ten turn potentiometer dial, with readings linear and proportional. A further change of 2.5 to 1 (3 to 1 for Model 255) is obtained by interchanging gears.

### MODEL 237 SMALL VARIABLE SPEED SYRINGE PUMP

The pump comes ready for operation with a holder for a 5 cc syringe. Extra holders (single or double) may be ordered for  $\frac{1}{4}$ , 1, 2, 5 and 10 cc syringes. Model 237 is available in a choice of 3 speeds, each covering a flow rate range of 40 to 1 with any one syringe, as shown on the FLOW RATE CHART.

### MODEL 255 LARGE VARIABLE SPEED SYRINGE PUMP

The pump is supplied with holder ready to accept a 50 cc syringe. Holders are available for 8 different size syringes from  $\frac{1}{4}$  cc to 100 cc capacity. Model 255 is available in three different speeds, each covering a flow rate range of 48 to 1 with a single syringe.

SEE FLOW RATE CHART FOR DETAILS.



**FLOW RATE RANGES AVAILABLE WITH SAGE MODEL 255  
LARGE VARIABLE SPEED SYRINGE PUMP**

Syringe		100 cc	50 cc	20 cc	10 cc	5 cc	2 cc	1 cc	¼ cc
Model #	Drive Gear								
		ml/Day							
255-3	Small	2.5-39	1.5-25	0.75-12	0.42-6.7	0.27-4.3	0.16-2.5	0.04-0.69	0.02-0.34
	Large	7.4-118	4.6-74	2.3-36	1.3-20	0.81-13	0.47-7.5	0.13-2.1	0.06-1.0
		ml/Hr							
255-2	Small	2.0-32	1.3-20	0.62-9.9	0.35-5.6	0.22-3.6	0.13-2.1	0.04-0.57	0.02-0.28
	Large	6.1-98	3.8-61	1.9-30	1.0-17	0.67-11	0.39-6.2	0.11-1.7	0.05-0.86
		ml/Min							
255-1	Small	0.61-9.8	0.38-6.1	0.19-3.0	0.105-1.7	0.067-1.1	0.039-0.63	0.011-0.17	0.005-0.086
	Large	1.84-29	1.15-18	0.56-9.0	0.31-5.0	0.20-3.2	0.117-1.9	0.032-0.52	0.016-0.26

**FLOW RATE RANGES AVAILABLE WITH SAGE MODEL 237  
SMALL VARIABLE SPEED SYRINGE PUMP**

Syringe		10 cc	5 cc	2 cc	1 cc	¼ cc
Model #	Drive Gear					
		ml/Day				
237-3	Small	1.7-27	1.1-17	0.62-10	0.17-2.8	0.09-1.4
	Large	4.2-67	2.7-43	1.6-25	0.43-6.9	0.22-3.4
		ml/Hr				
237-2	Small	1.4-22	0.9-14	0.52-8.3	0.14-2.3	0.07-1.1
	Large	3.5-56	2.2-36	1.3-21	0.36-5.8	0.18-2.9
		ml/Min				
237-1	Small	0.42-6.7	0.27-4.3	0.16-2.5	0.04-0.69	0.02-0.35
	Large	1.1-17	0.67-11	0.39-6.3	0.11-1.7	0.05-0.86

**FLOW RATES AVAILABLE WITH SAGE MODEL 249  
LARGE CONSTANT SPEED SYRINGE PUMP**

Syringe		100 cc	50 cc	20 cc	10 cc	5 cc	2 cc	1 cc	¼ cc
Model #	Drive Gear								
		ml/Day							
249-6	A	14.7	9.2	4.50	2.53	1.62	0.94	0.26	0.13
	B	29.4	18.4	9.00	5.06	3.24	1.88	0.52	0.26
	C	44.1	27.7	13.5	7.59	4.86	2.82	0.78	0.39
		ml/Hr							
249-5	A	2.45	1.53	0.746	0.421	0.269	0.156	0.043	0.021
	B	4.90	3.06	1.49	0.842	0.538	0.311	0.086	0.042
	C	7.35	4.59	2.24	1.26	0.707	0.467	0.129	0.064
249-4	A	9.83	6.14	3.00	1.68	1.08	0.622	0.172	0.085
	B	19.7	12.3	6.00	3.37	2.16	1.24	0.344	0.171
	C	29.5	18.4	9.00	5.05	3.24	1.86	0.516	0.256
249-3	A	39.3	24.5	12.0	6.73	4.31	2.49	0.688	0.341
	B	78.6	49.1	24.0	13.5	8.62	4.98	1.38	0.682
	C	117.	73.6	36.0	20.2	12.9	7.47	2.06	1.02
		ml/Min							
249-2	A	2.45	1.53	0.746	0.421	0.269	0.156	0.043	0.021
	B	4.90	3.06	1.49	0.842	0.538	0.311	0.086	0.042
	C	7.35	4.59	2.24	1.26	0.707	0.467	0.129	0.064
249-1	A	9.83	6.14	3.00	1.68	1.08	0.622	0.172	0.085
	B	19.7	12.3	6.00	3.37	2.16	1.24	0.344	0.171
	C	29.5	18.4	9.00	5.05	3.24	1.86	0.516	0.256

Rates shown are nominal since syringes vary. Syringe holders are designed to hold most standard syringes of a given capacity, Yale, Multifit, etc.

It should be noted that syringes leak, particularly at the slower rates. Leakage is greatest with Multifit syringes, and less with Yale type. Leakage can be minimized by applying sterile grease to syringe plunger.

Gears are interchangeable by simply lifting and dropping in place. The gear used on the drive shaft (shaft with cross pin) determines the rate. The following table of gears and driving speed factors may be used in calibrating rates for an individual syringe.

Drive Gear	Speed Factor
A (basic small)	1
B (M-259)	2
C (basic large)	3

# FLOW RATES AVAILABLE WITH SAGE MODEL 234

## SMALL CONSTANT SPEED SYRINGE PUMP

Syringe	10 cc	5 cc	2 cc	1 cc Tuberculin	¼ cc Tuberculin
Model	Drive Gear	ml/Day			
234-7	A	2.24	1.44	0.829	0.229
	B	3.36	2.16	1.24	0.344
	C	4.49	2.88	1.66	0.458
	D	5.60	3.60	2.07	0.573
234-6		ml/Hr			
	A	0.421	0.269	0.156	0.0430
	B	0.631	0.404	0.233	0.0645
	C	0.842	0.538	0.311	0.0860
234-5	D	1.05	0.673	0.390	0.108
	A	1.68	1.08	0.622	0.172
	B	2.52	1.62	0.933	0.258
	C	3.37	2.16	1.24	0.344
234-4	D	4.20	2.70	1.56	0.430
	A	6.73	4.31	2.49	0.688
	B	10.1	6.47	3.73	1.03
	C	13.5	8.62	4.98	1.38
234-3	D	16.8	10.8	6.22	1.72
		ml/Min			
	A	0.449	0.287	0.166	0.0460
	B	0.674	0.431	0.249	0.0690
234-2	C	0.898	0.574	0.332	0.0920
	D	1.12	0.720	0.415	0.115
	A	1.68	1.08	0.622	0.172
	B	2.52	1.62	0.933	0.258
234-1	C	3.37	2.16	1.24	0.344
	D	4.20	2.70	1.56	0.430
	A	6.73	4.31	2.49	0.688
	B	10.1	6.47	3.73	1.03
	C	13.5	8.62	4.98	1.38
	D	16.8	10.8	6.22	1.72

Rates shown are nominal since syringes vary. Syringe holders are designed to hold most standard syringes of a given capacity, Yale, Multifit, etc.

It should be noted that syringes leak, particularly at the slower rates. Leakage is greatest with Multifit syringes, and less with Yale type. Leakage can be minimized by applying sterile grease to the plunger.

Gears are interchangeable by simply lifting and dropping in place. The gear used on the drive shaft (shaft with cross pin) determines the rate. The following table of gears and driving speed factors may be used in calibrating rates for an individual syringe.

Drive Gear	Speed Factor
A (basic small)	1
B (M-226 small)	1½
C (M-226 large)	2
D (basic large)	2½

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# SAGE INSTRUMENTS, INC.

2 SPRING STREET, WHITE PLAINS, NEW YORK • WHITE PLAINS 9-4121

September 29, 1964

Mr. T. Nelson  
Independent Consultant  
Box 1546  
Poughkeepsie, New York 12603

Ref: Your inquiry via SCIENCE 7/24/64 concerning Sage Micro-Flow Pumps

Dear Sir:

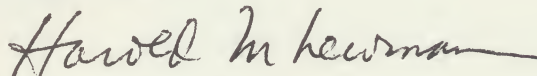
We are enclosing data concerning two lines of pumps which have broad application both in the laboratory and in clinical work.

One is the new line of inexpensive Sage Syringe Pumps, for accurate, reproducible infusion of fluids at flow rates from 0.11 ml/day to 29.5 ml/min. They operate off 117 V 60 cps current with great accuracy regardless of variations in line voltage. Applications range from intravenous feeding and other medical uses to use in connection with flame photometry, atomic absorption spectrophotometry, titration, electrophoresis, chromatography, etc.

The other is the portable, battery-operated Micro-Flow Pump which is now available in three sizes: 1, 2 $\frac{1}{2}$ , and 10 ml capacities. New miniature batteries (made for us specifically by Mallory) and a new electrolyte make these pumps reliable and inexpensive to operate. Each pump comes complete with five permanently re-useable flow rate-setters covering a range of from 1 ml/half hr to 1 ml/24 hr. In addition to its many applications in animal research, the Micro-Flow Pump is proving extremely useful in chemotherapy where it permits long term, continuous infusion of ambulatory patients.

We look forward to your orders, and to answering any questions you may have concerning pumps for the medical, biological, and analytical fields.

Sincerely,



Harold M. Newman  
President

HMN:eeep  
Enclosures